A PRELIMINARY APPRAISAL OF THE BIOLOGICAL INTEGRITY OF THE EAST FORK WHITE LICK CREEK IN THE WEST FORK WHITE RIVER WATERSHED USING FISH COMMUNITY ASSESSMENT

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ABSTRACT

A biological community assessment conducted during July 1997 in response to requests by IDEM's Permits and Modeling Sections in the Office of Water Management to assess potential or existing impacts that may have occurred or may now be occurring in the East Fork White Lick Creek Basin due to run-off of deicing agents used at the Indianapolis International Airport (IIAP). In addition, the Section 401 Water Quality Certification Program requested any information available related to the East Fork of White Lick Creek and its tributaries in support of review of an application for Section 401 Water Quality Certification for the construction of a new interchange at Six Points Road and I-70.

Based on a survey of the fish species, an Index of Biotic Integrity was calculated for five locations on the stream. Two of the locations were upstream of the IIAP while 3 were downstream. Qualitative Habitat Evaluations were also performed at each location as well as general chemistry and qualitative land use descriptions.

Results of the assessment shows the East Fork White Lick Creek to be of generally good quality based solely on IBI results. Thirty-four species were collected during this one day sampling event. Quality of the stream seems to decrease proceeding upstream to the headwaters. These upstream sites rated as poor and fair for the most upstream and second site downstream respectively. The lower three sites received a good rating showing a recovery from upstream perturbations that are limiting the quality of the upper 8 miles or so of this stream. Top level carnivores seem to be generally lacking in the East Fork White Lick Creek. This is one indicator that this stream is not of high quality and is experiencing stress. In addition, pioneer and tolerant species made up a higher proportion of the community as one moved upstream indicating local environmental stress.

Based on the results of the study, no adverse impacts can be attributed to the Indianapolis International Airport causing decline in the biological integrity of the East Fork White Lick Creek. The three sampling locations downstream of the airport discharge points indicated "good" community structure of the ambient fish community.

The proposed reconstruction of a portion of the in-stream channel of the East Fork White Lick Creek, if not planned properly, could have a detrimental effect on the downstream biological communities. Even though the East Fork White Lick Creek rated as "good" for the lower half of the stream in a fish community assessment, in-stream and riparian habitat alterations could cause a decrease downstream in biological community integrity due to additional stresses affected on aspects of the biological community that are currently marginal in quality. Mitigation efforts should focus on recreating and improving local habitat, riparian cover, and in-stream morphology in order to maintain habitat structure required by the species present and, at a minimum, protect from further degradation the current biological integrity of the East Fork White Lick Creek.

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INTRODUCTION

In response to requests by IDEM's Permits and Modeling Sections in the Office of Water Management fish community sampling was conducted to assess potential or existing impacts that may have occurred or may now be occurring in the East Fork White Lick Creek Basin due to run-off of deicing agents used at the Indianapolis International Airport (IIAP). In addition, the Section 401 Water Quality Certification Program requested additional information related to the condition of the East Fork of White Lick Creek and its tributaries in support of an application for Section 401 Water Quality Certification for the construction of a new interchange at Six Points Road and I-70.

Background

-Watershed Description

The East Fork White Lick Creek originates in western Marion County and flows south to its confluence with White Lick Creek near the Mooresville wastewater treatment facility in Morgan County which in turn flows into the West Fork White River in Morgan County. The stream drains 52 square miles of watershed which includes urban, industrial, and rural agricultural runoff. The stream has been reported to possess good fish habitat and have a high potential for recreational use (1982-83 Indiana 305b Report). The East Fork White Lick Creek originates in a heavily settled and industrialized region of Marion County. The East Fork White Lick Creek and its tributaries receive several permitted discharges as well as nonpoint runoff impacts. Historically, there were large meat packaging plants which discharged to the stream. The result was that the East Fork White Lick Creek had been severely degraded through the years. The most obvious result of this was a serious decline of the aquatic life, especially the fishery (1982-83 Indiana 305b Report). The present assessment status of East Fork White Lick Creek for 3 miles downstream of Indianapolis is considered partially supporting of aquatic life due to urban, industrial and agricultural nonpoint sources of degradation, also the effects of past municipal and industrial discharges and spills in the form of metals (1992-93 Indiana 305b Report).

-Available Biological Information

Aquatic macroinvertebrates were collected in 1992 at C.R. 800S in Hendricks Co.(river mile 2.8) which is well below the vicinity of the Indianapolis International Airport. The provisional biological assessment classification category of East Fork White Lick Creek at this location, based on this data, indicated moderate impairment while the habitat location assessment indicated partially supporting (1992-93 Indiana 305b Report). Calibration of biological integrity expectations for fish communities is continuing, but least impacted condition calibrations have not been completed for this ecoregion (Eastern Cornbelt Plains Ecoregion) by which to compare community sampling results.

The IDEM has collected fish tissue and surficial aquatic sediment for contaminants analysis within the White Lick Creek watershed. There is currently a limited consumption Fish Consumption Advisory specifically for creek chub, northern hogsucker, and yellow bullhead (ISDH 1997). This advisory is due to total PCBs found in samples collected in 1990.

A 1994 segment survey report for the White Lick Creek Basin revealed high levels of *E. coli*, well above the 235/100ml daily maximum standard (Miller 1994). The source(s) were Listed as “unknown, possible runoff, or septic tank seepage.”

-Issues

The current issue of concern is that IIAP primarily uses two chemicals that can increase biochemical oxygen demand in stream. One is propylene glycol from airplane deicing and the other is potassium acetate from pavement deicing. Propylene glycol is primarily used at the east end of the airport which drains to Seerley Creek and Mars Ditch. Potassium acetate is primarily used on the runways at the west end of the airport. Surface runoff containing these deicing agents flow into the East Fork of White Lick Creek from 4 outfalls which span a distance of 1.5 miles. From the use of pavement deicing agents, the potential BOD can be very large (several hundred mg/l during small precipitation events) going into the East Fork White Lick Creek from these outfalls (John Elliott, Modeling Section, IDEM). The East Fork of White Lick Creek enters the main stem White Lick Creek over 8 miles downstream of the last outfall location. The IIAP owns land adjacent to a 5 mile stretch of the East Fork White Lick Creek below the last outfall. This land has been designated as a wildlife refuge. The East Fork of White Lick Creek in the vicinity of the airport has an annual 7-day, once in 10 year low flow ($7Q_{10}$) of 0.56 cfs (John Elliott, Modeling Section, IDEM).

An additional issue is that the Department of Capital Asset Management, City of Indianapolis intends to create a major interchange at the junction of Six Points Road and I-70 which would entail the reconstruction of a 1,605 linear foot section of the East Fork White Lick Creek, a 3,595 linear foot section of North Creek, and a 740 linear foot section of the South Branch of North Creek. Reconstruction consists of the creation of a new stream channel to move the waterways in question out of the construction zone in which the interchange will be built.

The 401 Program wishes to use available data, such as IBI metrics and QHEI assessments to determine the integrity of aquatic and riparian habitat within the construction zone. The 401 Program determines if project impacts will have a detrimental effect on aquatic communities, if impacts can be mitigated, and how the habitat must be reconstructed to be adequate for existing aquatic organisms. If project impacts would be unmitigatable or be detrimental to a high-quality aquatic community, then the information requested would be used to provide a legal defense for the Office of Water's final 401 Water Quality Certification (WQC) decision.

This study evaluated the current biological condition of the East Fork White Lick Creek in the West Fork White River Basin based on fish community and habitat attributes. Evaluations of biological integrity of the fish community can give an accurate assessment of the environmental health of this stream and provide the 401 WQC Program the information it needs.

METHODS AND MATERIALS

All work was performed in accordance with current operating procedures (IDEM-BSS SOP 1992) for electrofishing, habitat assessment, and quality assurance for fish community sampling. Fish were collected from the East Fork White Lick Creek at five different locations (see Table 1) using a Smith-Root, Inc. SR-6 Tote Barge system. This equipment consisted of a generator powered pulsator #2.5 on a 2500 watt generator. The settings were 60 pulses per second at approximately 350 volts D.C. for all fishing locations. Each location was fished beginning at the station's bridge and proceeding in an upstream direction. The fishing area included 15 times the average wetted width of the stream at each location. All locations except the uppermost site were fished for 150 meters. The uppermost location was fished for 100 meters. A variety of in stream habitat types were sampled at each location including pools, runs, and riffles. Eleven to fifteen times the average stream width for a reach is generally adequate to sample two cycles of habitat (Leopold *et al.* 1964). All fish were collected using dipnets equipped with 0.32 cm mesh netting. One crew member electroshocked while at least two individuals netted the fish and placed them into a live well.

After each site collection was completed all fish in the sample were separated and identified to species. The largest and smallest individual of each species was measured at total length and a batch weight of all individuals obtained. At least one voucher specimen of each species was retained for each site. All other fish were released as quickly as possible in order to minimize mortality. All identifications and measurements were recorded on standard fish community assessment sheets used by the Biological Studies Section.

In addition to fish collection, a Qualitative Habitat Evaluation (QHEI) (Rankin 1989) was performed at each of the five sites and a QHEI score tallied for each site (IDEM-BSS SOP 1992). Water quality parameters of temperature, dissolved oxygen, pH, and specific conductivity were also measured at the time of fish sampling using a Hydrolab Scout 2 display and H20 data sonde.

Information recorded on site data sheets included the site, county, location, ecoregion code, natural region code (Homoya 1985), USGS hydrologic unit, latitude/longitude, IDEM segment number, drainage area (square miles), and stream gradient (ft/mile). The latitude/longitude coordinates and stream gradients were determined using 7.5 minute topographic maps. The drainage area was estimated using 7.5 minute topographic maps and Hoggatt's (1975) "Drainage Areas of Indiana Streams."

All site, habitat, and fish species accounts were entered into the Biological Studies Section's fish community data base (FISHTRAK) and IBI calculations were completed. Index of Biotic Integrity scores were calculated using the metrics and calibration for the Central Cornbelt Plains Ecoregion wadeable and headwater stream sites (Simon 1991) because calibration for the Eastern Cornbelt Plains Ecoregion has not been completed. Preliminary data evaluations by Biological Studies Staff indicate the Eastern Cornbelt Plains Ecoregion calibration will be similar to the Central Cornbelt Plains Ecoregion. Organisms less than 20mm were excluded from the IBI calculations. Early life stages exhibit high mortality (Simon 1991) and are difficult to identify and to collect with gear designed for larger fish (Angermeier and Karr 1986).

RESULTS AND DISCUSSION

Stream sampling locations for the East Fork White Lick Creek are listed in Table 1. Qualitative Habitat Evaluation Index (QHEI) scoring results are listed in Table 2. The species accounts for fish at each location and their counts are listed in Table 3. Table 4 lists the attributes of Index of Biotic Integrity (IBI) classification, total IBI scores, and integrity classes used to classify the quality of each sampling reach. Table 5 lists the IBI community metrics for headwater streams (<20 square miles drainage). Table 6 lists the IBI community metrics for wadeable streams (>20 square miles drainage). Site EFWL18 was the only site that required headwater stream metrics having less than 20 square miles of watershed drainage. All other locations wadeable streams metrics were used for the IBI calculation. Table 7 lists the metric proportion calculations and their score based on the Central Cornbelt Plains Ecoregion calibration (Simon 1991). The calibrations were developed based on maximum species richness lines drawn following the procedures of Fausch *et al.* (1984) and Ohio EPA (1988).

All sites were of similar habitat quality. Land use immediately around all sites was dominated by agriculture except for EFWL18 which was dominated by urban development. Site EFWL9 was the first downstream site of the IIAP. This is the site that would be expected to have the most adverse impacts occurring due to IIAP run-off if impact is, in fact, occurring. All substrates were dominated by sand and gravel with what appeared to be a normal silt load except for EFWL18 which had a moderate silt load.. No site had an unusually large amount of substrate embeddness. Except for the uppermost site (EFWL18), all stream locations had very open canopy to no canopy cover (EFWL9).

Table 1. Fish community sampling and habitat evaluation locations in the East Fork White Lick Creek study area, July 1997. (Hydrologic unit 05120201150) downstream to upstream.

Site Number	Stream mile	Location	County	Latitude	Longitude	Drainage Area (sq. miles)	7.5 minute USGS Quad map
downstream of IIAP							
EFWL3	2.8	Old S.R. 67	Morgan	39 37' 29"	86 21' 26.2"	45	Mooresville East, IN
EFWL5	4.7	C.R.800S	Hendricks	39 38'47.5"	86 20' 46"	41	Bridgeport, IN
EFWL9	9.2	C.R.450S	Hendricks	39 41' 53.5"	86 19' 52"	30	Bridgeport, IN
upstream of IIAP							
EFWL12	12.4	Bridgeport Rd..	Marion	39 44' 18"	86 19' 00"	24	Bridgeport, IN
EFWL18	17.5	County Line Rd..	Hendricks	39 47' 19.5"	86 19' 38"	17	Clermont, IN

IIAP=Indianapolis International Airport

Table 2. Qualitative Habitat Evaluation Index (QHEI) scores (maximum metric score designated within parentheses) for evaluating sites in the East Fork White Lick Creek during July 1997.

	Downstream--------------------------------	-------------------------------	|Upstream ----------------------	---------------------->	
Metric	**EFWL3**	**EFWL5**	**EFWL9**	**EFWL12**	**EFWL18**
Qualitative Habitat Score (total)	**72**	**57**	**50**	**55**	**62**
Substrate (20)	11	11	13	12	12
In stream Cover (20)	11	7	7	9	12
Channel Morphology (20)	19	10	8	11	14
Riparian zone & Bank Erosion (10)	9	10	5	4	5
Pool/Glide Quality (12)	10	9	6	8	5
Riffle/Run Quality (8)	2	2	1	3	4
Gradient (10)	10	8	10	8	10
Average Width (meters)	9.8	10.0	10.2	9.0	6.0
Percent pool (estimation)	25	15	20	60	70
Percent riffle (estimation)	20	15	20	20	10
Percent run (estimation)	55	70	60	20	20
% canopy openness (estimation)	90	75	100	80	10
Temperature (Celsius)	22.8	23.7	32.4	27.6	24.7
pH	7.91	8.02	8.33	8.30	8.16
Dissolved (mg/l)	5.65	6.53	12.22	9.42	6.34
specific conductivity (useimen)	712	710	722	873	951
Time of day (military)	0800	1000	1330	1600	1800

(#)=total possible points for the metric.

Table 3. Summary of fish collected from each site in the East Fork White Lick Creek Basin, July 1997. Sites are listed from downstream to upstream. Numbers are the number of individuals counted.

	Downstream---	--------	---------|Upstream	------------------------------->	
Species	**EFWL3**	**EFWL5**	**EFWL9**	**EFWL12**	**EFWL18**
Clupeidae					
gizzard shad	3				
Cyprinidae					
blacknose dace		11	4	33	45
bluntnose minnow	18	52	257	36	3
central stoneroller		311	698	378	199
common carp			1	5	
creek chub	144	278	109	271	512
fathead minnow		4	6	6	1
redfin shiner	1				
sand shiner	29	110	243	103	
silverjaw minnow	2	50	631	107	4
spotfin shiner	18	28	16	3	
striped shiner	6	21	41	14	3
suckermouth minnow		29	58	25	
Catostomatidae					
black redhorse	26	12	8	3	
golden redhorse	5				
highfin carpsucker	1				
northern hogsucker	20	31	16	25	
quillback			8		
silver redhorse	4				
white sucker	91	122	101	126	274
Ictularidae					
yellow bullhead			1		1
brown bullhead			1		
Cottidae					
mottled sculpin	60	93			
Centrarchidae					
bluegill	1	8	2	3	2
green sunfish	16	33	41	38	47
longear	11	14	14		
longear/green hybrid	6	3	2	1	
rock bass	3	2			
spotted bass	2	2	1	6	
Percidae					
dusky darter	1				
greenside darter	1				
johnny darter	71	158	101	298	27
orangethroat darter	15	30	19	90	8
rainbow darter		14	20		
Total number of individuals	555	1416	2399	1571	1126
Total number of species*	24	22	24	19	13

(*=does not include hybrids)

Table 4. Attributes of Index of Biotic Integrity (IBI) classification, total IBI scores, and integrity classes from Karr *et al.* (1986).

Total IBI score	**Integrity Class**	**Attributes**
58-60	Excellent	Comparable to the best situation without human disturbance; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with a full array of age (size) classes; balanced trophic structure.
48-52	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundances or size distributions; trophic structure shows some signs of stress.
40-44	Fair	Signs of additional deterioration including loss of intolerant forms, fewer species, highly skewed trophic structure (e.g. increasing frequency of omnivores and other tolerant species); older age classes of top predators may be rare.
28-34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.
12-22	Very Poor	Few fish present, mostly introduced or tolerant forms; hybrids common; disease, parasites, fin damage, and other anomalies regular.
	No Fish	Repeated sampling finds no fish.

Table 5. Index of Biotic Integrity (IBI) metric used to evaluate the sites with less than 20 square miles of drainage in the East Fork White Lick Creek during July 1997 (Simon 1991).

Metric Category	**Metric**	**Scoring Classification 5**	**3**	**1**
Species composition	Total Number of Species	Varies with drainage area		
	Number Darter/Sculpin/ Madtom species	Varies with drainage area		
	% Headwater species	>26.6%	13.3-26.6	<13.3
	Number of Minnow Species	Varies with drainage area		
	Number Sensitive Species	Varies with drainage area		
	% Tolerant Species	<25.0%	25.1-49.9	≥50.0
Trophic Composition	% Omnivores <=20 square miles	Varies with drainage area		
	% Insectivores <=20 square miles	Varies with drainage area		
	% Pioneer Species	<24.7%	24.7-49.4	>49.4
Fish Condition	Catch per Unit Effort	Varies with drainage area		
	% Simple Lithophils	>34.0%	16.5-33.9	<16.5
	%DELT anomalies	<0.1%	0.1-1.3%	>1.3

Table 6. Index of Biotic Integrity (IBI) metric used to evaluate the sites with greater than 20 square miles of drainage (“wadeable sites”) in the East Fork White Lick Creek during July 1997 (Simon 1991).

Metric Category	**Metric**	**Scoring Classification** 5	3	1
Species composition	Total Number of Species	Varies with drainage area		
	Number Darter species	Varies with drainage area		
	Number of Sunfish Species	4	2-3	<2
	Number of Sucker Species	Varies with drainage area		
	Number of Sensitive Species	Varies with drainage area		
	% Tolerant Species	≤25.0%	25.1-49.9	≥50.0
Trophic Composition	% Omnivores >20 square miles	<19.3%	19.3-38.7	.38.7
	% Insectivores >20 square miles	≤25.0%	25.1-49.9	>50.0
	% Carnivores	>5.0%	2.1-5.0	≤2.0
Fish Condition	Catch per Unit Effort	Varies with drainage area		
	% Simple Lithophils	≥34%	16.5-33.9	<16.5
	%DELT anomalies	<0.1%	0.1-1.3	>1.3

Table 7. Index of Biotic Integrity calculated metric proportions and metric scores (in parenthesis) for evaluating sites in the East Fork White Lick Creek during July 1997.

	Downstream----------------------------------|Upstream ----------------------->				
Metric	**EFWL3**	**EFWL5**	**EFWL9**	**EFWL12**	**EFWL18**
Qualitative Habitat Score (total)	**72**	**57**	**50**	**55**	**62**
Total number of Species*	24 (5)	22 (5)	24 (5)	19 (5)	13 (5)
Number of Darter Species	4 (5)	3 (5)	3 (5)	2 (3)	n/a
Number Darter/Sculpin/Madtom	n/a	n/a	n/a	n/a	2 (3)
% Headwater Species	n/a	n/a	n/a	n/a	4 (1)
Number of Sunfish Species	4 (5)	4 (5)	3 (3)	2 (3)	n/a
Number of Sucker Species	6 (5)	5 (5)	4 (5)	3 (5)	n/a
Number of Minnow Species	n/a	n/a	n/a	n/a	7 (5)
Number of Sensitive Species	10 (5)	6 (5)	5 (5)	3 (3)	0 (1)
% Tolerant Species	49 (3)	35.3 (3)	22.0 (5)	32.8 (3)	78.4 (1)
% Omnivores	20.4 (3)	12.6 (5)	15.5 (5)	11.0 (5)	24.7 (3)
% Insectivores	51.7 (3)	44.6 (3)	50.5 (5)	45.1 (3)	8.2 (1)
% Carnivores	0.9 (1)	0.3 (1)	0.0 (1)	0.4 (1)	n/a
% Pioneer Species	n/a	n/a	n/a	n/a	71.1 (1)
Catch per Unit Effort	555 (5)	1416 (5)	2399 (5)	1571 (5)	1126 (5)
% Simple Lithophils	30.3 (3)	19.1 (3)	11.1 (1)	20.1 (3)	29.3 (3)
% DELT anomalies	0.0 (5)	0.0 (5)	0.0 (5)	0.0 (5)	0.0 (5)
Total IBI Score:	**50**	**50**	**50**	**44**	**34**
Integrity Class	**Good**	**Good**	**Good**	**Fair**	**Poor**

n/a=metric not applicable to site.
*=does not include hybrids

A total of 34 fish species were documented in the East Fork White Lick Creek Basin during this study (See Table 7). Index of Biotic Integrity calculations were completed based on species counts, and total and relative numbers of individuals. Functional feeding group, reproductive guild, tolerance, and sensitivity classifications were based on Simon (1991). The three downstream sites sampled exhibited a “good” rating. Site EFWL12 (located at Bridgeport Rd.) exhibited a “fair” rating, and the uppermost site, EFWL18, exhibited a“poor” rating (see Tables 3 and 6). A trend of increasing biological integrity was evident proceeding downstream from the headwater site to the stream mouth.

Based on community concepts, the IBI relies on multiple parameters to evaluate a complex system. The cumulative multi metric score of an IBI results in a standardized assessment for the quality of a water resource. A further look at individual metrics provides insight into the causes of impairment from an ideal reference condition. The individual metrics were selected based on their attributes’ sensitivities, within the community, to the human induced pressures put on the water resources. Metrics used for wadeable and headwater sites are listed in tables 5 and 6 respectively. A short discussion of each metric follows.

The total number of species or “species richness” is used for both headwater and wadeable stream classification types. The species richness at the East Fork White Lick Creek sites ranged from a high of 24 at EFWL3 to a low of 13 at EFWL18 (Tables 3 and 7). The premise behind this metric is that the number of species increases directly with environmental complexity and quality of the aquatic resource (Karr 1981; Karr *et al.* 1986). Total number of species is strongly correlated with drainage area at headwater and wading sites. Thus, even though EFWL18 had far fewer species than the downstream wadeable sites it still received a high score. This single metric is considered to be one of the most powerful metrics in resolving water resource issues because a direct correlation exists between high quality water resources and high numbers of species for warmwater assemblages (Simon 1991).

The presence of darter species in wadeable sites is indicative of a quality resource. Darters require high dissolved oxygen concentrations, are intolerant to toxicants and siltation, and thrive with clean substrates. Darters are insectivorous, habitat specialists. They are excellent indicators of a quality resource, generally in riffle habitats (Simon 1991). For headwater sites, madtom and sculpin species are also included. Sculpins and madtoms are also benthic insectivores and functionally occupy the same niche as darters (Simon 1991). Their inclusion enables a greater degree of sensitivity in evaluating streams that naturally have fewer darter species. These metric categories also exhibit a strong relationship with increasing drainage area for headwater and wadeable streams. As seen in Table 7, the downstream sites receive the highest standard score for this metric (5) while the upper two sites received only a moderate IBI score (3).

The number of sunfish species is used for wadeable streams and is replaced with proportion of headwater species for streams of less than 20 square miles of drainage. Neither of these metric categories are affected by increasing drainage area. The “basses” are not included in the number of sunfish species metric but are included in the proportion of carnivores metric. The number of sunfish species is an important measure of pool habitat quality (Simon 1991). It measures degradation of rock substrates and in stream cover (Pflieger 1975; Trautman 1981), and the associated aquatic macroinvertebrate community which are an important food resource for sunfish (Forbes and Richardson 1920; Becker 1983). Sunfish normally occupy slower moving water which may act as sinks, or traps, for accumulation of toxins and siltation. Karr *et al.*(1986) found sunfish to occupy the intermediate to upper ends of sensitivity of the index of biotic integrity. The proportion of headwater species is alternately used when drainage area is less than 20 square miles (Ohio EPA 1987). The presence of indicator headwater species indicates the presence of permanent habitat with low environmental stress (Simon 1991). As with the number of darter species metric score, the number of sunfish species metric score in the EFWL decreases going upstream even though the percentage of pool habitat of sufficient depth increases in the upstream sites. Also, the score for proportion of headwater species (1) indicates stressful conditions in the headwater reach.

Suckers represent a major component of the Indiana fish fauna since their total biomass usually ranks them among the highest contributors to the community (Simon 1991). The general intolerance of most round-bodied sucker species to habitat and water quality degradation (Karr *et al.* 1986; Simon 1991; Trautman 1981) makes them one of the most sensitive indicators at the higher end of environmental quality. Conversely, in small headwater streams sucker species are not a dominant member of the community. The number of minnow species metric is substituted for the number of sucker species at headwater sites because of the expected low numbers of sucker species in small streams (Ohio EPA 1987). Simon (1991) has found as many as 10 minnow species at locations of drainage area of less than 5 square miles. The number of minnow species also increases with improved environmental quality (Simon 1991). Minnow species have representatives of both tolerance and intolerance to environmental disturbance thus giving this metric representation at both ends of the environmental quality gradient. Simon (1991) showed a direct relationship between the number of minnow species, as well as number of sucker species, and drainage area for Indiana streams. Scoring results (Table 7) show that both sucker and minnow species are well represented in the East Fork White Lick Creek Basin.

The number of sensitive species helps to distinguish between streams of highest quality (Simon 1991). Intolerant, or sensitive species are those that decline with decreasing environmental quality and disappear, as viable populations, when the aquatic environment degrades to the “fair” category (Karr *et al.* 1986; Simon 1991). There is a trend of decreasing environmental quality as the number of sensitive species declines in the East Fork White Lick Creek from a high standardized score to a low standardized score proceeding upstream to the upper reaches. Sensitive species observed included the sand shiner, black redhorse, golden redhorse, and northern hogsucker. Sand shiner, black redhorse, and northern hogsucker were absent from EFWL18. Based on observations from numerous stream samples in Indiana, we would expect the black redhorse to be absent from this reach, but not necessarily the sand shiner or the northern hogsucker. Golden redhorse was only found at EFWL3 (Table 3).

Percent tolerant species is used to detect decline in stream quality within the fair to poor categories (Simon 1991). Fourteen tolerant species are recognized in Indiana to be highly tolerant (Simon 1991). These include, but are not limited to bluntnose minnow, common carp, creek chub, fathead minnow, redfin shiner, white sucker, yellow bullhead, brown bullhead, and green sunfish. The bluntnose minnow reaches a relative peak at EFWL9 but declines significantly both upstream and downstream. This location was the most productive yielding a significantly higher catch per unit effort than anywhere else. This site had the least amount of riparian cover and virtually no shading. Common carp were found only at EFWL9 and EFWL12.

Green sunfish attained their highest proportion of the community at the uppermost site, EFWL18. In all, tolerant species made up 78.4% of the community at EFWL18 while all of the other locations were less than 50% of the community make-up.

The proportion of omnivores measures the relative proportion of omnivorous feeders within the entire community. This metric evaluates the intermediate to low categories of environmental quality (Simon 1991). This metric is drainage area dependent for headwater and wadeable sites. Dominance of the community by omnivores would suggest specific components of the food base are less reliable, increasing the success of more opportunistic species. The lower the proportion of omnivores the higher the standardized score. Sites EFWL3 and EFWL18 scored a 3 while all others scored a 5 (highest).

The proportion of insectivores measures the relative proportion of insectivorous feeders within the entire community. This metric is intended to respond to an underlying impaired fish food base within the benthic macroinvertebrate community (Simon 1991). This metric also varies with drainage area at the headwater and wadeable streams levels. As ecological disturbance increases, the diversity of insect larvae decreases, triggering an increase in the omnivorous trophic level. This metric thus varies inversely with the proportion of omnivores metric which increases with environmental degradation. Both the stamdardized score and the actual proportion of insectivores fall off significantly going upstream from EFWL12 to EFWL18.

The proportion of carnivores metric measures community integrity in the upper trophic levels of the fish community. It is only in high quality environments that upper trophic levels are able to flourish (Simon 1991). There has been no correlation to drainage area found for Indiana streams (Simon 1991). In the entire East Fork White Lick Creek there appears to be a lack of individuals and species in this trophic level. For headwater streams, however, proportion of pioneer species was substituted. Headwater reaches do not usually have a high abundance of carnivores. Pioneer species has been alternatively suggested by Ohio EPA (1987). Pioneer species are the first to colonize sections of headwater streams after desiccation (Simon 1991). These species also predominate in unstable environments affected by anthropogenic stresses and temporal desiccation. A high proportion of pioneer species indicates a temporally-unavailable, or stressed environment. This metric does not change with increase in drainage area. The only location where proportion of pioneers was calculated was the uppermost site (EFWL18). Here pioneer species made up 71.1% of the fish community, a strong indication of environmental stress or a previous disturbance.

Catch per unit effort expresses a relative number of individuals per length of reach sampled. Our unit of effort was determined based on the total number of individuals collected per 15 times the channel width. When low numbers of individuals are observed the normal trophic relationships are generally disturbed enough to have severe effects on fish abundance. As integrity increases, total abundance increases and becomes more variable depending on the level of energy and other natural chemical factors limiting production (Simon 1991). Under certain circumstances, e.g., channelization, increases in the abundance of tolerant fishes can be observed (Ohio EPA 1987). Catch per unit effort was certainly not a limiting factor in the East Fork White Lick Creek. Fish were extremely abundant at all locations. These high catch rates may be reflective of high productivity brought on by enrichment and nutrient loads. This is a stream of primarily agricultural land use. Higher water and habitat quality may be mitigating any toxic or inhibitory effects such enrichment could have on the fish community.

Simple lithophilic spawners are species that simply drop their eggs amongst the gravel and cobble in the stream and leave them to develop and hatch on their own. Reproductive attributes of simple spawning behavior requires clean gravel or cobble for success. Berkman and Rabeni (1987) observed an inverted correlation between simple lithophil spawners and the proportion of silt in streams. Although seemingly normal, siltation may be inhibiting this reproductive class of spawners. Siltation and embeddness for all locations was generally moderate as indicated by the QHEI.

The proportion of individuals with deformities, eroded fins, lesions, and tumors (DELT anomalies) metric evaluates the health of individual fish in the community using the percent occurrence of external anomalies. Studies of fish populations indicate that anomalies are either absent or occur at very low rates naturally, but reach higher percentages at impacted sites (Mills *et al.* 1966). Primary causes result from bacterial, fungal, viral, and parasitic infections, neoplastic diseases, and chemicals. An increase in the frequency of occurrence of these anomalies is an indication of stress and environmental degradation caused by chemical pollutants, overcrowding, improper diet, excessive siltation, and other perturbations (Simon 1991). No DELT anomalies were observed at any of the locations sampled.

SUMMARY

A biological community assessment was conducted during July 1997 in response to requests by IDEM's Permits and Modeling Sections in the Office of Water Management to assess potential or existing impacts that may have occurred or may now be occurring in the East Fork White Lick Creek Basin due to run-off of deicing agents used at the Indianapolis International Airport (IIAP). In addition, the Section 401 Water Quality Certification Program requested any information available related to the East Fork of White Lick Creek and its tributaries in support of review of an application for Section 401 Water Quality Certification for the construction of a new interchange at Six Points Road and I-70.

Based on a survey of the fish species, an Index of Biotic Integrity was calculated and for five locations on the stream. Two of the locations were upstream of the IIAP while 3 were downstream. Qualitative Habitat Evaluations were also performed at each location as well as general chemistry and qualitative land use descriptions.

Results of the assessment shows the East Fork White Lick Creek to be of generally good quality based solely on IBI results. Thirty-four species were collected during this one day sampling event. Quality of the stream seems to decrease proceeding upstream to the headwaters. The upstream sites rated as poor for the most upstream and as fair for the second site downstream. The lower three sites received a good rating showing a recovery from upstream perturbations that are limiting the quality of the upper 8 miles or so of this stream. Top level carnivores seem to be generally lacking in the East Fork White Lick Creek. This is one indicator that this stream is not of high quality and is experiencing stress. In addition, pioneer and tolerant species made up a higher proportion of the community as one moved upstream indicating local environmental stress.

Based on the results of the study, no adverse impacts can be attributed to the Indianapolis International Airport causing decline in the biological integrity of the East Fork White Lick Creek. The three sampling locations downstream of the airport discharge points indicated "good" community structure of the ambient fish community.

The proposed reconstruction of a portion of the in-stream channel of the East Fork White Lick Creek, if not planned properly, could have a detrimental affect on the downstream biological communities. Even though the East Fork White Lick Creek rated as "good" for the lower half of the stream in a fish community assessment, in-stream and riparian habitat alterations could cause a decrease downstream in biological community integrity due to additional stresses affected on aspects of the biological community that are currently marginal in quality. Mitigation efforts should focus on recreating and improving local habitat, riparian cover, and in-stream morphology in order to maintain habitat structure required by the species present and, at a minimum, protect from further degradation the current biological integrity of the East Fork White Lick Creek.

ACKNOWLEDGEMENTS

Special thanks to Jeff Frey and Todd Lynch of the USGS Indianapolis office, and John Elliott (Modeling Section, IDEM-OWM) for their assistance in completing the field work for this report.

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